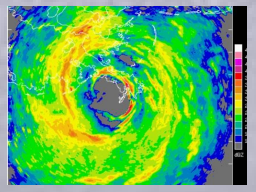
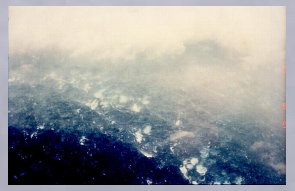
Hurricane Impacts


Mark Powell
AOML Program Review
18-20 March 2008

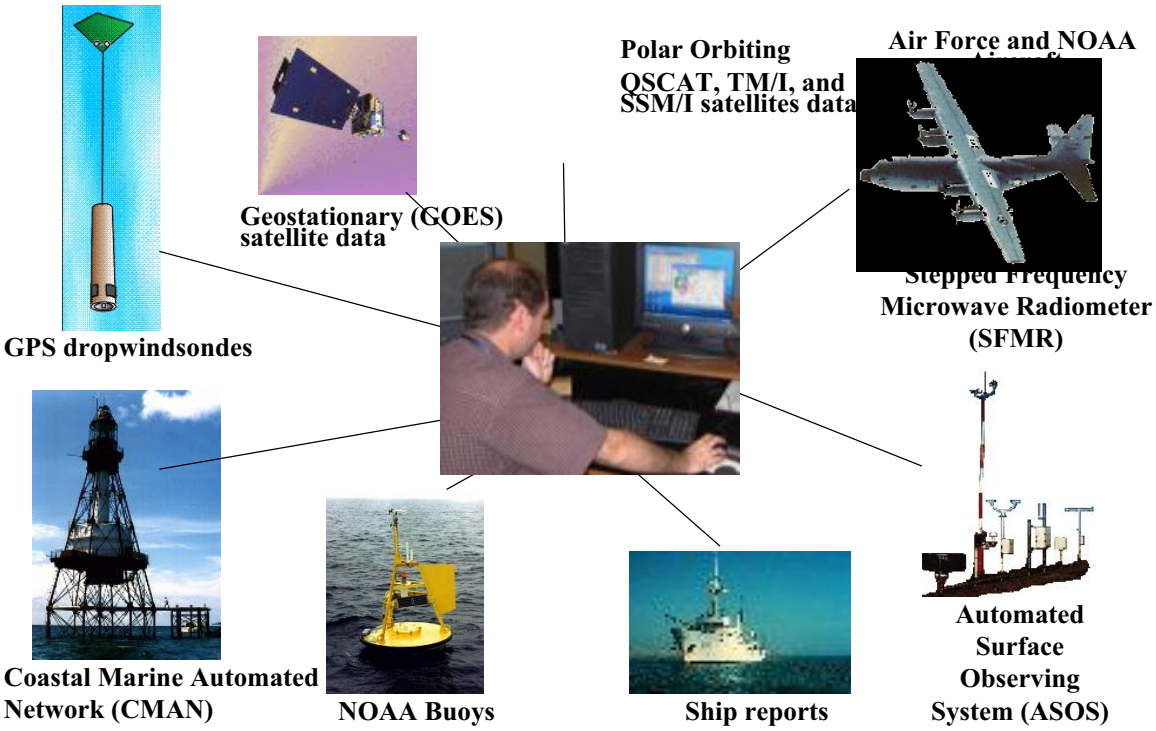
Key Questions

- *How do we integrate diverse observations?*
- *Do air-sea fluxes vary within a hurricane?*
- *Hurricanes are episodic events with ecosystem and climate change ramifications. How do we provide interdisciplinary mission support?*
- *What are the natural and human contributions to hurricane risk?*
- *What constitutes a "worst case" event in Florida?*

Impacts Outline

- Integrated and Adaptive Observations / Tools
- Ecosystems, Climate
- Wind Risk and Decay Modeling
- Rainfall Flooding
- Hurricane Risk
- Winds, Waves, Storm Surge

Integrated Observations



Tropical cyclone observations from space, sea, land, and air

Adaptive observations from aircraft and portable land-based sensors

Partnerships with public and private sectors

Adaptive Observing Network

NOAA ,Air Force, NASA, NRL, Aircraft

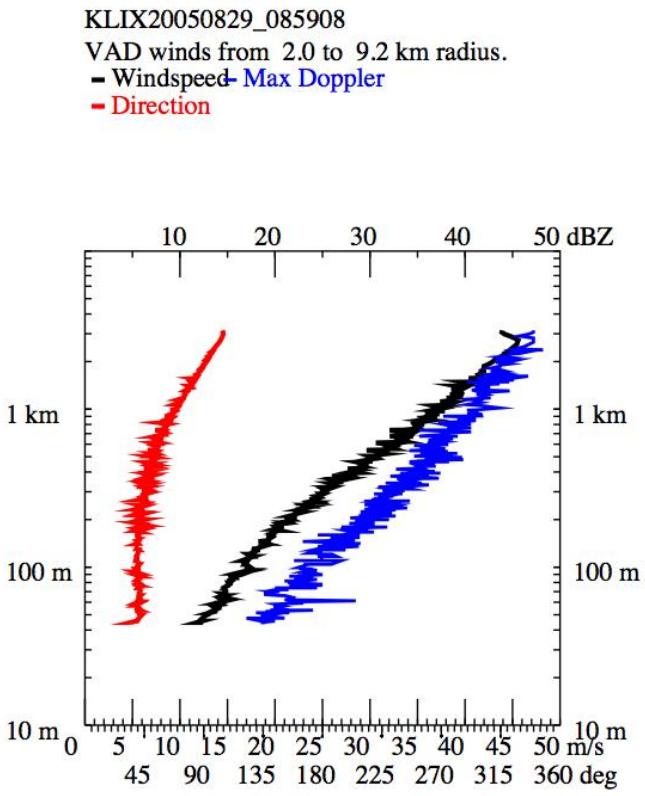
TCSP, Rainex, IFEX

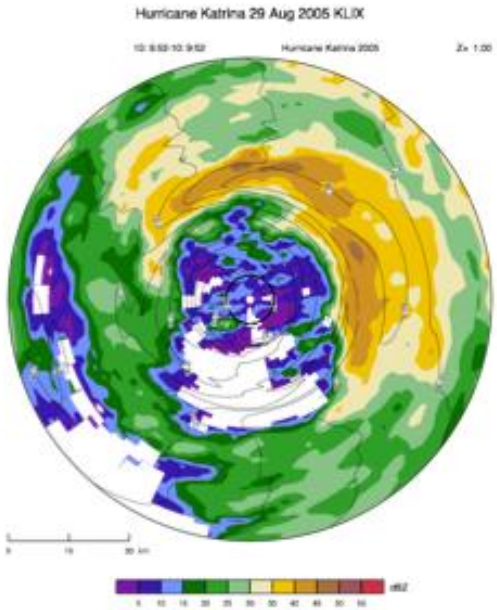
US Hurricane Landfall Coastal Network (TTU, UF, LSU, Clemson)

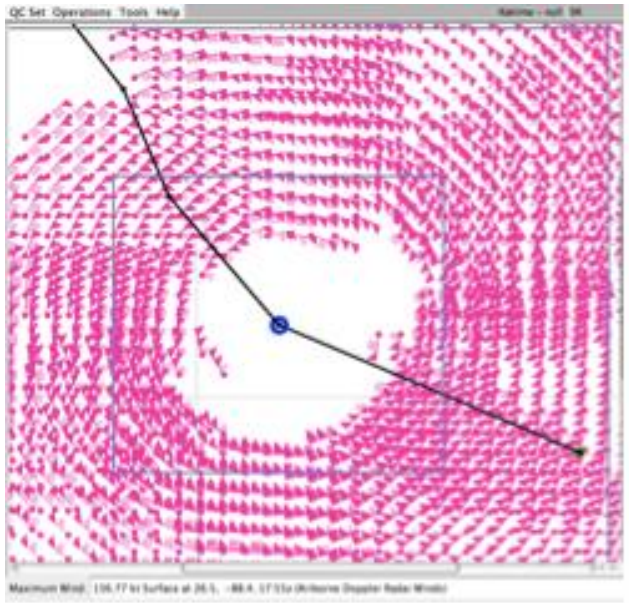
WeatherFlow
Managed Weather Networks & Solutions

Doppler Radars

- Land-based radars and GBVTD
- Airborne radars for DA and RTMA
- Post landfall event reconstruction





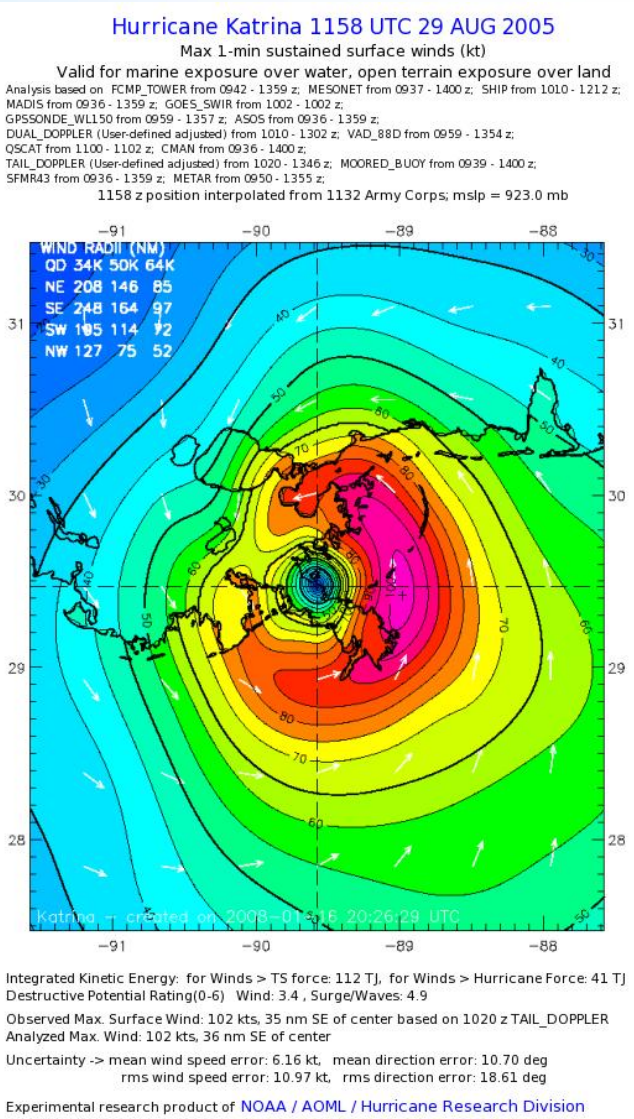


H*Wind

Scientists interact with observations to produce a real-time mesoscale analysis

Record of the event, disaster response

Basis for evaluating model performance (NASA Goddard, GFDL, NCAR)



Ecosystem and Climate impacts

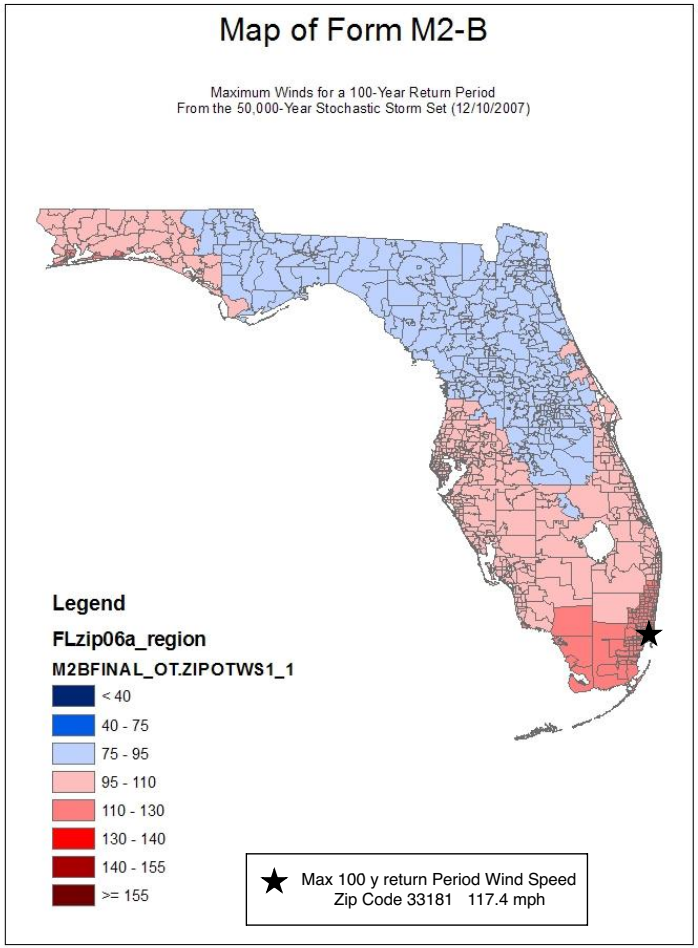
- Interdisciplinary Research Mission Support:
  - Hurricane Katrina's carbon footprint
  - Endangered species movement during hurricanes
  - Prediction of forest harvest loads
  - Sea turtle nesting patterns relative to hurricane landfalls
  - Chlorophyll enhancement in the Gulf of Mexico
  - Forest disturbance
  - Resource management of forested wetlands

Risk Modeling

State of Florida

Public Hurricane Loss Model

- State of Florida Public Hurricane Loss Model
- Thousands of years of hurricane activity modeled
- Winds input to damage model and losses aggregated
- Average annual loss computed at each zip code



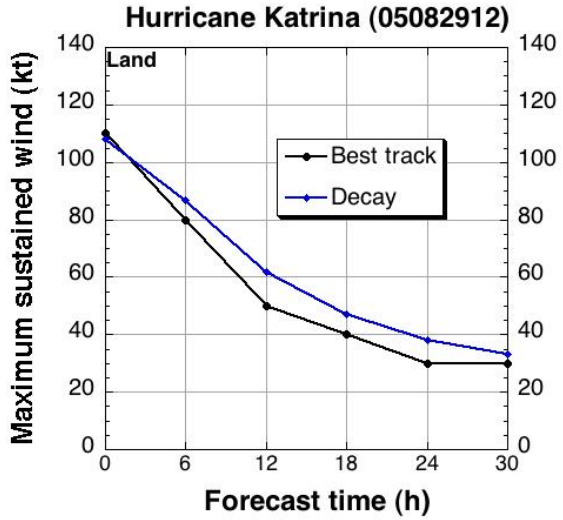
Inland winds

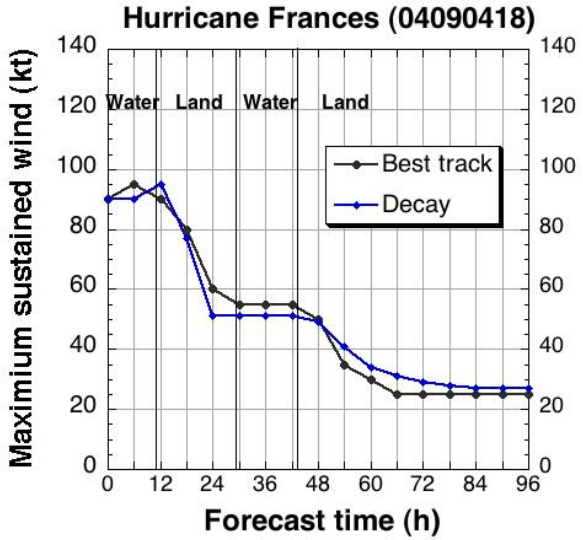
Inland Decay Model

Real-time estimates of the maximum wind and wind radii

Based upon the official TPC forecast

Transitioned to NHC





Rainfall flooding

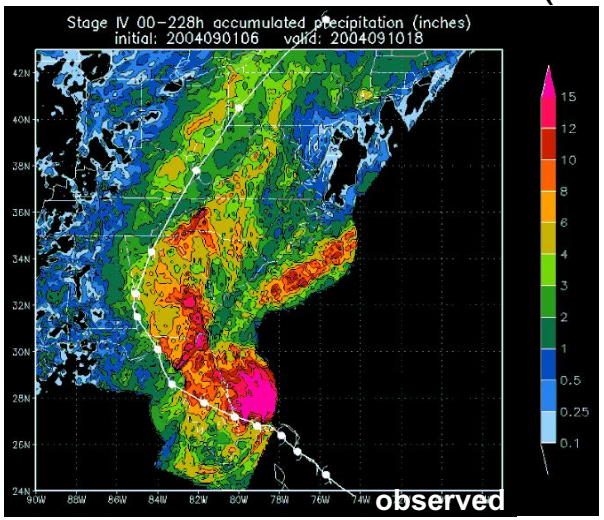
Parametric Hurricane Rainfall Model (PHRaM)

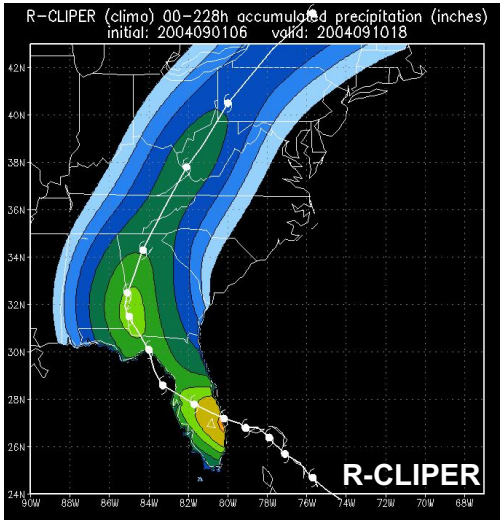
- Based on R-CLIPER
  - adds effect of vertical shear, terrain

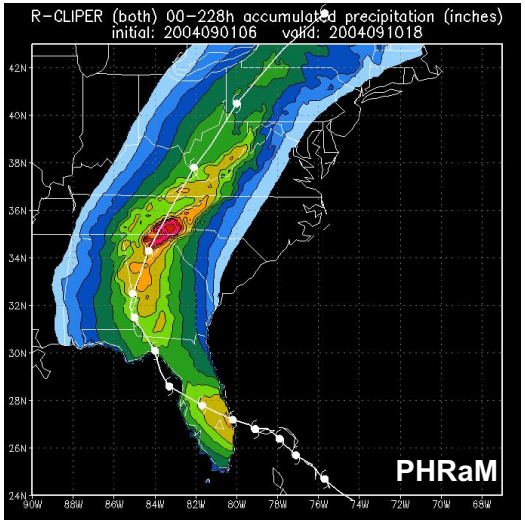
- Can provide benchmark for verifying numerical model rainfall forecasts

- Successfully transitioned to operations via JHT

Storm-total rainfall for Ivan (2004)





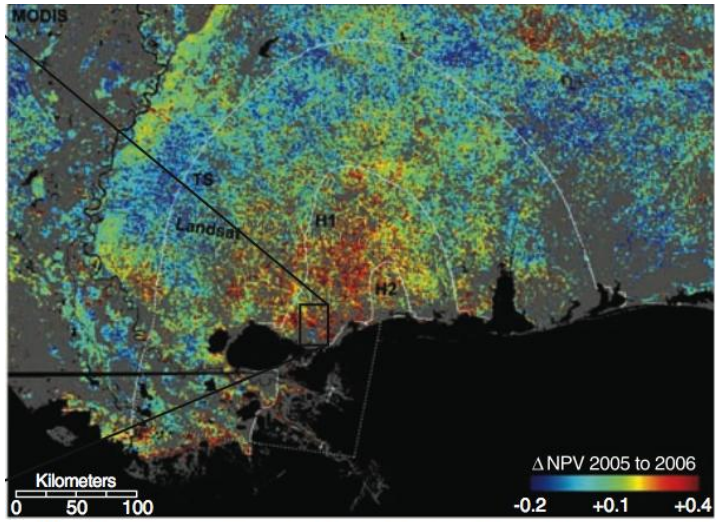


Winds, Waves, Surge

- Wind field surface stress forces the waves and surge
- Establish the surface friction thru GPS sonde research
- Gridded wind fields help drive surge, wave, damage models
- Alternative measures of the storm impact to improve warning process and evaluate models

BAMS 2007

20 March 2003



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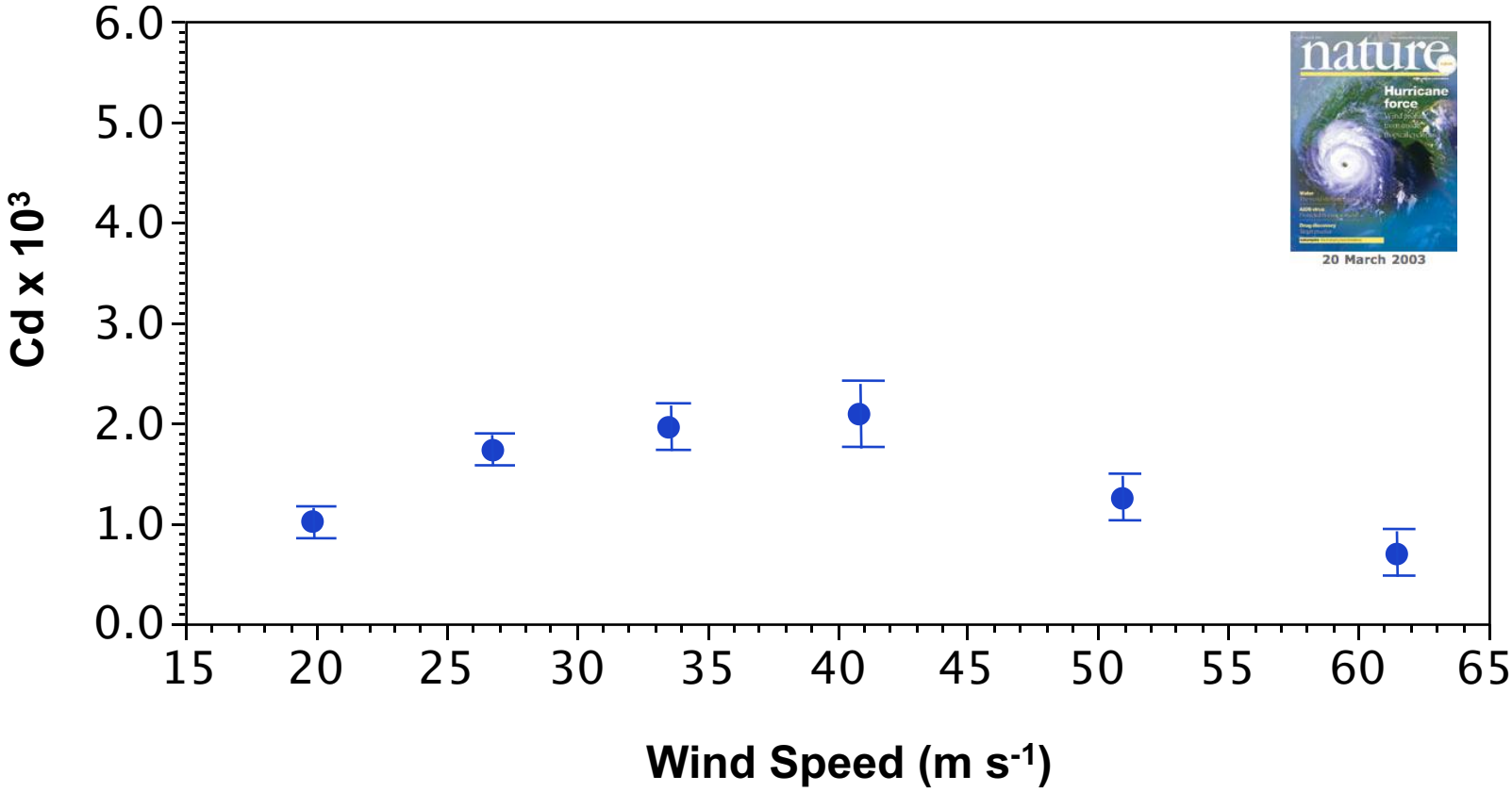
Chambers, Tulane

The aerodynamic roughness of the sea depends on sea state:

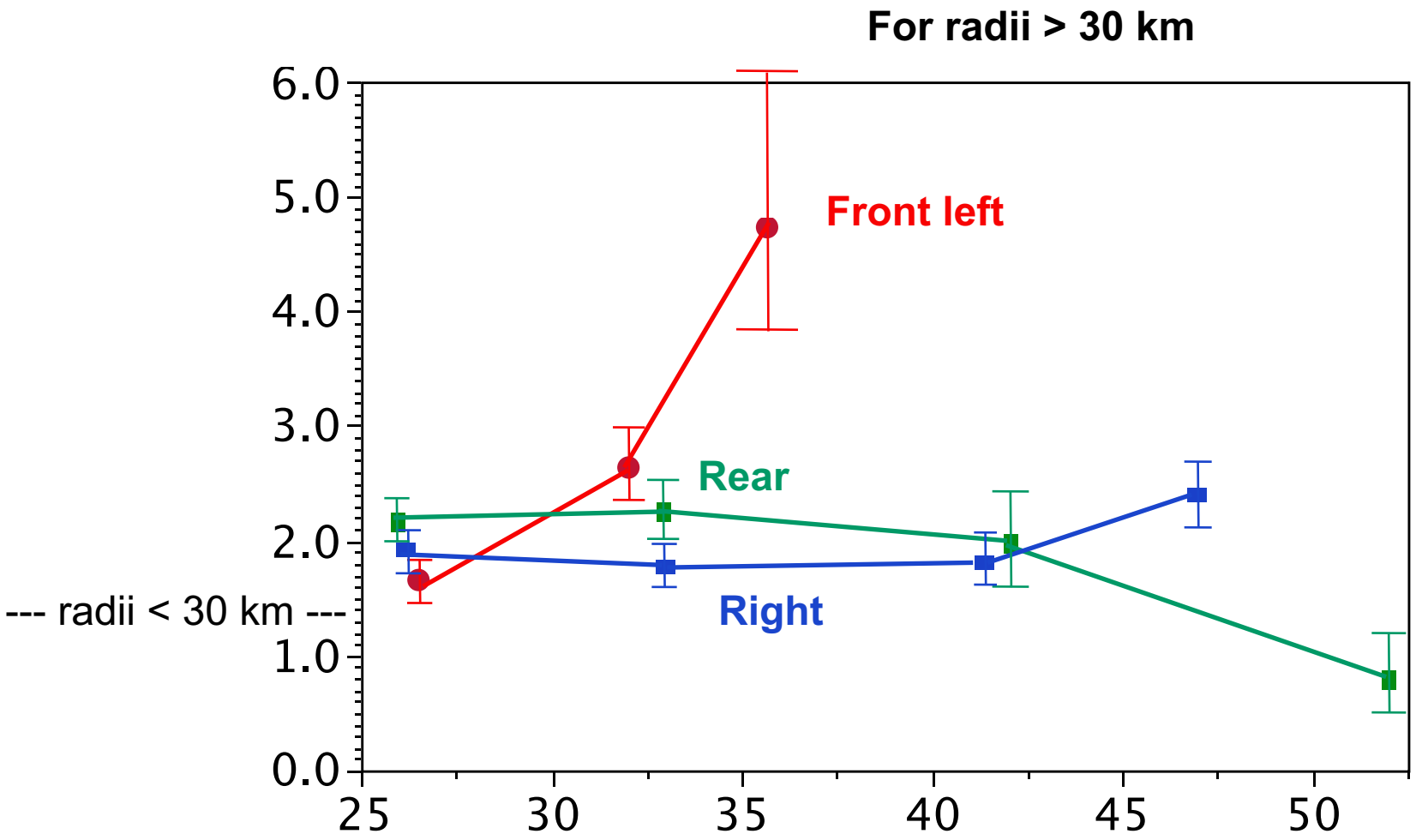
- **Wind Speed**
- **Bubbles**
- **Sea Spray**
- **wave steepness**
- **wave motion relative to the wind**

These factors vary with position in the storm

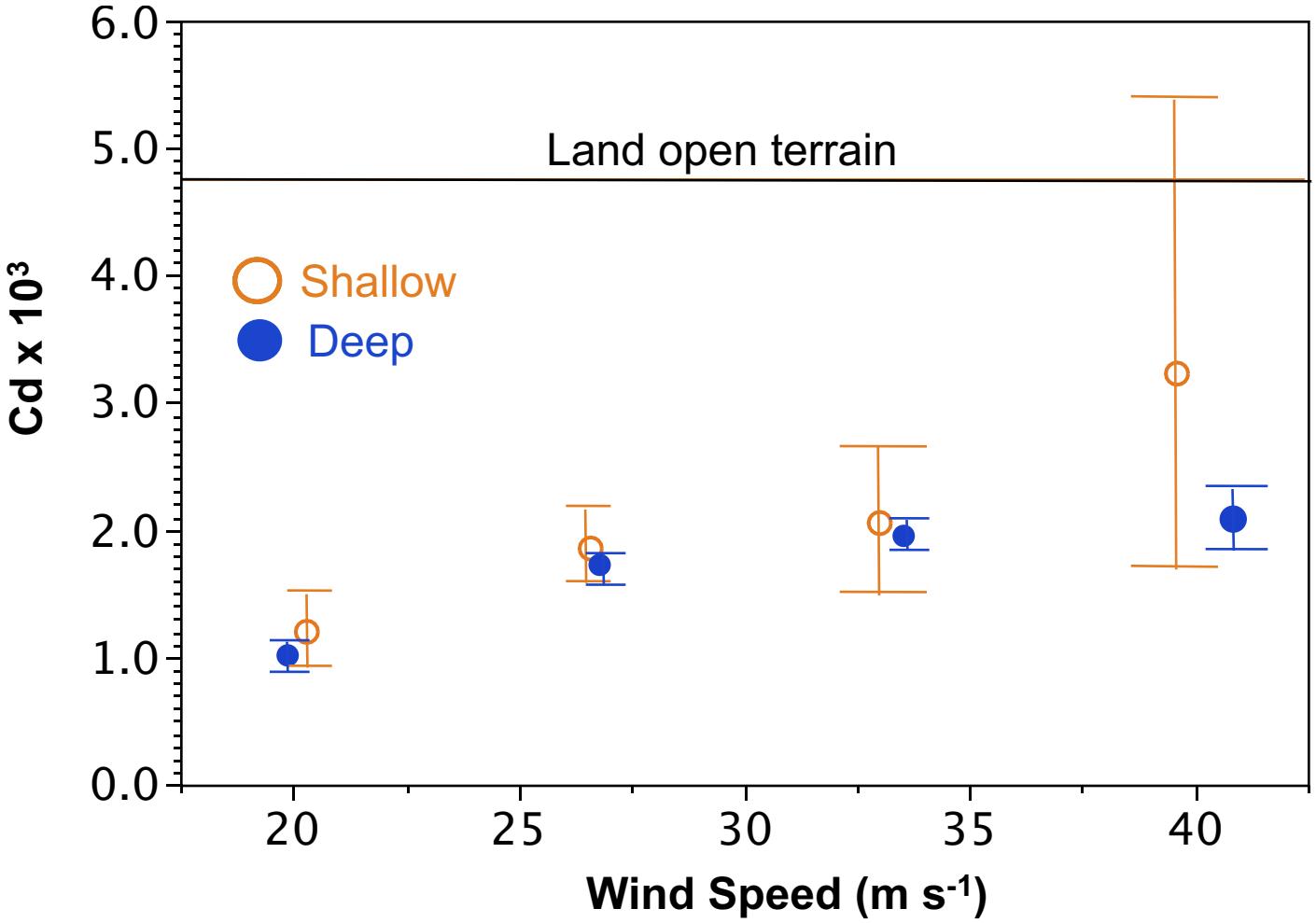
Drag Coefficient: wind speed



Drag Coefficient: storm radius, azimuth



Drag Coefficient: water depth




QUESTIONS?

Background Material

Link to AOML-HRD Hurricane Impacts web page

http://www.aoml.noaa.gov/hrd/programs_sub/Hurricane_WindsLandfall.html